

## CLAIMS

What is claimed is:

- 5           1.       A semiconductor structure, comprising:  
a monocrystalline silicon substrate;  
an amorphous oxide material overlying the monocrystalline silicon substrate;  
a monocrystalline perovskite oxide material overlying the amorphous oxide  
material;
- 10           a first monocrystalline compound semiconductor material overlying the  
monocrystalline perovskite oxide material;  
a microcavity semiconductor laser formed at least partially of said  
monocrystalline compound semiconductor material; and  
a waveguide overlying said microcavity semiconductor laser.
- 15           2.       The semiconductor structure of Claim 1, wherein said waveguide overlying  
said microcavity semiconductor laser is optically coupled to said microcavity  
semiconductor laser.
- 20           3.       The semiconductor structure of Claim 1, wherein said waveguide overlying  
said microcavity semiconductor laser is optically coupled to said microcavity  
semiconductor laser with an evanescent wave coupling.
- 25           4.       The semiconductor structure of Claim 1, wherein said waveguide is  
formed at least partially from a second monocrystalline compound semiconductor  
material.
- 30           5.       The semiconductor structure of Claim 4, wherein said second  
monocrystalline compound semiconductor material is substantially the same as said first  
monocrystalline compound semiconductor material.

6. The semiconductor structure of Claim 1, wherein said microcavity semiconductor laser comprises an elliptical cross-sectional periphery.

7. The semiconductor structure of Claim 6, wherein said elliptical cross-sectional periphery comprises a circular cross-sectional periphery.

8. The semiconductor structure of Claim 1, wherein said microcavity semiconductor laser comprises a microcavity semiconductor ring laser.

9. The semiconductor structure of Claim 1, wherein said microcavity semiconductor laser comprises a microcavity semiconductor disk laser.

10. The semiconductor structure of Claim 1, wherein said microcavity semiconductor laser comprises a distorted microcavity semiconductor ring laser.

11. The semiconductor structure of Claim 1, wherein said microcavity semiconductor laser comprises a distorted microcavity semiconductor disk laser.

12. The semiconductor structure of Claim 1, wherein said first monocrystalline compound semiconductor material forms an active lasing medium.

13. The semiconductor structure of Claim 12, wherein said active lasing medium supports resonant modes having wavelengths compatible with a radial dimension of the microcavity semiconductor laser.

14. The semiconductor structure of Claim 12, wherein said active lasing medium enables circulation of said plurality of photons about a periphery of said microcavity semiconductor laser in a manner capable of producing stimulated emission of radiation that generates a second plurality of photons capable of forming a lasing field within said active lasing medium.

15. The semiconductor structure of Claim 12, wherein said active lasing medium comprises a relatively high refractive index medium that is substantially surrounded by a relatively low refractive index medium.

16. The semiconductor structure of Claim 15, wherein said relatively high refractive index medium has a refractive index that is greater than approximately 2.5.

17. The semiconductor structure of Claim 15, wherein said relatively low refractive index medium has a refractive index that is less than approximately 2.0.

18. The semiconductor structure of Claim 15, wherein the ratio of the refractive indices of said relatively high refractive index medium and said relatively low refractive index medium is greater than approximately 1.3.

19. The semiconductor structure of Claim 12, wherein said active lasing medium comprises a first cladding layer overlying said monocrystalline perovskite oxide material.

20. The semiconductor structure of Claim 19, wherein said active lasing medium comprises an active layer overlying said first cladding layer.

21. The semiconductor structure of Claim 12, wherein said active lasing medium comprises of an active layer.

22. The semiconductor structure of Claim 21, wherein said active lasing medium comprises of a second cladding layer overlying said active layer.

23. The semiconductor structure of Claim 21, wherein said active layer comprises a quantum well.

24. The semiconductor structure of Claim 21, wherein said active layer comprises a plurality of quantum wells.

25. The semiconductor structure of Claim 21, wherein said active layer comprises a quantum well barrier layer.

26. The semiconductor structure of Claim 12, wherein said active lasing medium comprises a first cladding layer disposed between a first guiding layer and said monocrystalline perovskite oxide material.

27. The semiconductor structure of Claim 26, wherein said active lasing medium comprises a second guiding layer disposed between an active layer and a second cladding layer.

28. The semiconductor structure of Claim 1, wherein said monocrystalline compound semiconductor material comprises gallium arsenide (GaAs).

29. The semiconductor structure of Claim 1, wherein said monocrystalline compound semiconductor material comprises indium phosphide (InP)

30. The semiconductor structure of Claim 1, wherein said waveguide is coupled to said microcavity semiconductor laser with evanescent wave coupling at a segment of said microcavity semiconductor laser.

31. The semiconductor structure of Claim 1, wherein said microcavity semiconductor laser comprises:

- a first cladding layer overlying said monocrystalline perovskite oxide material;
- a first guiding layer overlying said first cladding layer;
- 5 an active layer overlying said first guiding layer;
- a second guiding layer overlying said active layer; and
- a second cladding layer overlying said second guiding layer.

32. The semiconductor structure of Claim 31, wherein said waveguide  
10 comprises a third cladding layer overlying said second cladding layer.

33. The semiconductor structure of Claim 32, wherein said waveguide  
comprises a third guiding layer overlying said third cladding layer.

34. The semiconductor structure of Claim 33, wherein said waveguide  
15 comprises a fourth guiding layer overlying said third guiding layer.

35. The semiconductor structure of Claim 33, wherein said waveguide  
comprises a second active layer overlying said third guiding layer.

36. The semiconductor structure of Claim 34, wherein said waveguide  
20 comprises a fourth cladding layer overlying said fourth guiding layer.

37. An electro-optical integrated circuit comprising the semiconductor  
25 structure of claim 1 for intra integrated circuit information communication.

38. An electro-optical integrated circuit comprising the semiconductor  
structure of claim 1 for inter integrated circuit information communication.

39. An electro-optic network node comprising the semiconductor structure of  
30 claim 1.

40. A semiconductor laser system, comprising:

a monocrystalline silicon substrate;

an amorphous oxide material overlying the monocrystalline silicon substrate;

a monocrystalline perovskite oxide material overlying the amorphous oxide  
5 material;

a monocrystalline compound semiconductor material overlying the  
monocrystalline perovskite oxide material; and

a plurality of microcavity semiconductor lasers formed at least partly from said  
monocrystalline compound semiconductor material;

10 a plurality of waveguides overlying said plurality of microcavity semiconductor  
lasers, said plurality of waveguides optically coupled to said plurality of semiconductor  
lasers with an evanescent wave coupling.

41. The semiconductor laser system of Claim 40, further comprising a plurality  
15 of optic cables coupled to said plurality of waveguides.

42. The semiconductor laser system of Claim 40, further comprising a control  
circuit connected to at least one of said plurality of microcavity semiconductor lasers and  
configured to control said at least one of said plurality of microcavity semiconductor  
20 lasers.

43. The semiconductor laser system of Claim 42 further comprising a second  
control circuit.

25 44. An electro-optical integrated circuit comprising the semiconductor  
structure of claim 40 for inter integrated circuit information communication.

45. An electro-optic network node comprising the semiconductor structure of  
claim 40.